

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 November 2002 (14.11.2002)

PCT

(10) International Publication Number
WO 02/091495 A3

(51) International Patent Classification⁷: H01L 51/20,
27/00, G11C 13/02

MANDELL, Aaron; 140 Marlborough Street, Apt. 3,
Boston, MA 02116 (US). PERLMAN, Andrew; 310
Marlborough Street, Boston, MA 02116 (US).

(21) International Application Number: PCT/US02/14269

(22) International Filing Date: 7 May 2002 (07.05.2002)

(74) Agent: YAMPOLSKY, Alexander, V.; McDermott, Will
& Emery, 600 13th Street, N.W., Washington, DC 20005-
3096 (US).

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/289,056 7 May 2001 (07.05.2001) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG,
SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN,
YU, ZA, ZM, ZW.

(71) Applicant: COATUE CORPORATION [US/US]; 25
Olympia Avenue, Suite B, Woburn, MA 01801 (US).

(72) Inventors: BULOVIC, Vladimir; MIT, 77 Massachusetts
Avenue, Room 13-3138, Cambridge, MA 02139 (US).

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: MOLECULAR MEMORY DEVICE

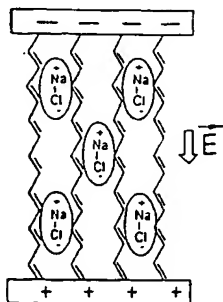


FIG. 1(a)

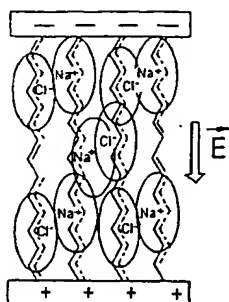


FIG. 1(b)

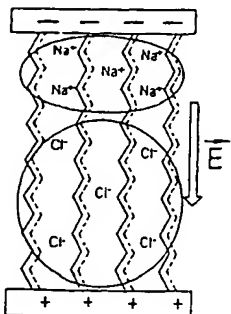


FIG. 1(c)

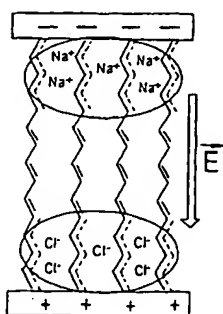


FIG. 1(d)

(57) Abstract: A novel memory cell is provided with an active region including a molecular system and ionic complexes distributed in the molecular system. A pair of write electrodes are arranged for writing information to the memory cell. The active region is responsive to an electric field applied between the pair of write electrodes for switching between an on state and an off state. The active region has a high impedance in the off and a low impedance in the on state. A pair of read electrodes is used to detect whether the active region is in the on state or in the off state to read the information from the memory cell. Read electrodes may be made of different materials having different work functions to reduce leakage current.

WO 02/091495 A3



Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR,
GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent
(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR,
NE, SN, TD, TG).

Published:

— with international search report

(88) Date of publication of the international search report:
21 August 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

BEST AVAILABLE COPY

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H01L51/20 H01L27/00 G11C13/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L G11C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JURI H KRIEGER ET AL: "Molecular Analogue Memory Cell" FORESIGHT CONFERENCE ON MOLECULAR NANOTECHNOLOGY, XX, XX, 12 November 1998 (1998-11-12), pages 1-9, XP002209014 page 1 page 2; figures 1,2 page 8 -page 9	1-49
X	US 4 652 894 A (POEHLER JR THEODORE O ET AL) 24 March 1987 (1987-03-24) figures 1,3 column 3, line 20 -column 4, line 35 column 7; claims --- -/--	1-49



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

27 March 2003

Date of mailing of the international search report

04/04/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax. (+31-70) 340-3016

Authorized officer

Paisdor, B

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/14269

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 034 192 A (KITTLESEN GREGG P ET AL) 23 July 1991 (1991-07-23) column 4, line 59 - line 68 column 10; example 1 column 12 -column 14; example 4 column 6, line 62 - line 68	1-49
X	EP 0 727 822 A (CANON KK) 21 August 1996 (1996-08-21) abstract; claim 1 figure 8	1,24,32, 34,43
X	EP 0 268 370 A (CANON KK) 25 May 1988 (1988-05-25) abstract; claims 1,4 figures 1,7 examples 1,2,5 page 2, line 36 - line 45 page 3, line 45 - line 48	1,24,32, 34,43
X	WO 99 04440 A (BEN JOSEPH GDALYAHU ;TECHNION RES & DEV FOUNDATION (IL); EICHEN YO) 28 January 1999 (1999-01-28) abstract; claims figures 4-1,4-2 page 44 -page 46; example 9	1,24,32, 34,43
X	KRIEGER Y H: "STRUCTURAL INSTABILITY OF ONE-DIMENSIONAL SYSTEMS AS A PHYSICAL PRINCIPLE UNDERLYING THE FUNCTIONING OF MOLECULAR ELECTRONIC DEVICES" JOURNAL OF STRUCTURAL CHEMISTRY, PLENUM PRESS, NEW YORK, NY, US, vol. 40, no. 4, 1999, pages 594-619, XP008005141 ISSN: 0022-4766 cited in the application page 610, paragraph 2.2.4 -page 611 page 603, paragraph 2.1.1. -page 604	1,24,32, 34,43
P,X	REED M A ET AL: "MOLECULAR RANDOM ACCESS MEMORY CELL" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 78, no. 23, 4 June 2001 (2001-06-04), pages 3735-3737, XP001073300 ISSN: 0003-6951 the whole document	1,24,32, 34,43
E	WO 02 091385 A (COATUE CORP) 14 November 2002 (2002-11-14) the whole document	1-49

-/--

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/14269

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of documents with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	WO 02 091494 A (COATUE CORP) 14 November 2002 (2002-11-14) the whole document	1-49
E	WO 02 091496 A (COATUE CORP) 14 November 2002 (2002-11-14) the whole document	1-49

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 02/14269

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4652894	A	24-03-1987	US 4371883 A US 4507672 A	01-02-1983 26-03-1985
US 5034192	A	23-07-1991	US 4895705 A US 4721601 A AU 605057 B2 AU 4787990 A AU 589920 B2 AU 5030685 A CA 1243419 A1 CA 1260159 A2 DE 3588098 D1 EP 0185941 A2 JP 2073456 C JP 7095052 B JP 62011159 A US 4936956 A US 4929313 A US 4717673 A	23-01-1990 26-01-1988 03-01-1991 10-05-1990 26-10-1989 05-06-1986 18-10-1988 26-09-1989 15-05-1996 02-07-1986 25-07-1996 11-10-1995 20-01-1987 26-06-1990 29-05-1990 05-01-1988
EP 0727822	A	21-08-1996	JP 8222648 A DE 69603632 D1 DE 69603632 T2 EP 0727822 A2 KR 234502 B1 US 5942779 A	30-08-1996 16-09-1999 06-04-2000 21-08-1996 15-12-1999 24-08-1999
EP 0268370	A	25-05-1988	JP 63296273 A JP 2039045 C JP 7077272 B JP 63096956 A JP 2010983 C JP 7048575 B JP 63160389 A DE 3751376 D1 DE 3751376 T2 EP 0268370 A2 US 5359204 A	02-12-1988 28-03-1996 16-08-1995 27-04-1988 02-02-1996 24-05-1995 04-07-1988 03-08-1995 16-11-1995 25-05-1988 25-10-1994
WO 9904440	A	28-01-1999	IL 121312 A AU 749432 B2 AU 8239798 A CN 1264498 T EP 0998759 A1 WO 9904440 A1 JP 2001510922 T US 2002171079 A1	13-09-2001 27-06-2002 10-02-1999 23-08-2000 10-05-2000 28-01-1999 07-08-2001 21-11-2002
WO 02091385	A	14-11-2002	WO 02091385 A1 US 2002163831 A1	14-11-2002 07-11-2002
WO 02091494	A	14-11-2002	WO 02091494 A1 US 2002163829 A1	14-11-2002 07-11-2002
WO 02091496	A	14-11-2002	WO 02091496 A2 US 2002163057 A1	14-11-2002 07-11-2002

Form PCT/ISA/210 (patent family annex) (July 1992)